

cancel only claim 29.

1 1. (Previously amended) A system for accelerating the
2 solution of treatment gas into a liquid stream, said system being
3 adapted to receive and maintain said stream under pressure, said
4 system comprising:

5 an aspirating injector comprising a body having an
6 axial passage, a converging section, a throat section and a
7 diverging section in said passage in that order, an injector port
8 through said body entering said throat section and adapted to
9 receive treatment gas to be dissolved in said liquid stream, said
10 passage having an inlet port to receive said stream, and an
11 outlet port;

12 a collider and a reactor, each having an inlet port and
13 an outlet port, the inlet port of one of them being connected to
14 the outlet port of the injector, its outlet port connected to the
15 inlet port of the other and; a fluid release receiving said
16 stream from said last mentioned outlet port for releasing the
17 treated stream from the system while maintaining the system under
18 pressure:

19 said collider comprising a body forming a chamber, a
20 pair of nozzles opposing one another, said stream being divided
21 so a portion flows through each said nozzle with their streams
22 flowing toward and meeting one another in said chamber, said body
23 having an outlet port exiting the chamber; said outlet comprising

24 the exit for all of the stream which entered said chamber.

1 2. (Original) A system according to claim 1 in which said
2 fluid release comprises a gas/liquid separator which separates
3 and releases the stream's liquid and the stream's gases which
4 remain undissolved in said liquid.

1 3. (Original) A system according to claim 2 in which said
2 fluid release further includes a regulator valve for the liquid
3 stream.

1 4. (Original) A system according to claim 2 in which said
2 separator is a centrifugal separator.

1 5. (Cancelled) A system according to claim 1 in which said
2 collider comprises a body forming a chamber, pair of nozzles
3 opposing one another, said stream being divided so a portion
4 flows through each said nozzle with their streams flowing toward
5 and meeting one another in said chamber, said body having an
6 outlet port exiting the chamber.

1 6. (Previously Amended) A system according to claim 1 in
2 which said portions of said stream intersect at an included angle
3 not larger than 90 degrees.

1 7. (Previously Amended) A system according to claim 1 in
2 which said portions of said stream are axially aligned, and in
3 which said exit port exits the chamber laterally, midway betwe n
4 said nozzles.

1 8. (Previously Amended) A system according to claim 1 in
2 which each of said nozzles includes a converging section, and
3 twisting vanes in said converging section whereby to impart a
4 rotary motion to the outer region of the stream as it flows
5 through the nozzle.

1 9. (Previously Amended) A system Apparatus according to
2 claim 1 in which said reactor comprises a body having a central
3 axis with an internal cylindrical wall forming an axial int rnal
4 cylinder, its said inlet port adapted to receive said stream, and
5 its said outlet port adapted to discharge said stream with an
6 increased dissolved amount of said treatment gas therein, said
7 inlet port and said outlet port being centrally located on said
8 central axis;

9 a nozzle in said inlet port directing said stream
10 axially into said cylinder;

11 a partial barrier extending laterally across said
12 cylinder dividing said cylinder onto a first chamber and a second

13 chamber, said barrier having an upstream face facing into said
14 first chamber and axially facing said nozzle, and a downstream
15 face facing into said second chamber and facing said outlet port;
16 said upstream face having a concave circular first
17 reflecting surface centered on said central axis and facing said
18 nozzle, the radius of said reflecting surface being smaller than
19 the internal radius of said internal cylindrical wall;
20 a plurality of axially extending arcuate blades, each
21 having an outer wall closely fitting to said internal cylindrical
22 wall, a dimension of radial thickness, and an inner wall
23 concentric with its said outer wall, said blades having axially-
24 extending side walls, said blades being angularly spaced from one
25 another to provide an equal number of axial slots between them;
26 a cove surface circularly surrounding said first
27 nozzle, extending to said inner walls of the blades and to their
28 intersections with said slots, whereby said stream discharges
29 from said nozzle so a major portion of it strikes said reflecting
30 surface, which reverses a major portion of the flow to the cove
31 surface which in turn reflects a major portion of said flow
32 toward said barrier along said blades and in said slots, said
33 partial barrier being pierced between with slots between said
34 slots to provide for flow from said first chamber into said
35 second chamber, thereby to pass said flow from the first chamber
36 into said second chamber, said outlet port discharging from said

37 second chamber.

1 10. (Previously Amended) A system according to claim 9 in
2 which said second chamber comprises a partial barrier facing
3 toward said outlet port, a plurality of blades and slots as in
4 said first chamber, said slots in the first and second chamber
5 being rotationally displaced from one another, whereby to form
6 joggle shoulders encountered by portions of the stream flowing
7 across the barriers, said second chamber including a cove
8 receptive of some of the flow across the barrier to reflect at
9 least some of the flow of the stream to the barrier in said
10 second chamber, which in turn reflects it to said outlet port.

1 11. (Previously Amended) A system according to claim 10 in
2 which said fluid release comprises a gas/liquid separator which
3 separate and releases the stream's liquid and the stream's gas s
4 which remain undissolved in said liquid.

1 12. (Cancelled) A system according to claim 3 in which said
2 fluid release comprises a gas/liquid separator which separates
3 and releases the stream's liquid and the stream's gases which
4 remain undissolved in said liquid.

1 13. (Previously Amended) A system according to claim 11 in

2 which said separator is a centrifugal separator.

1 14. (Cancelled) Apparatus according to claim 10 in which
2 said collider comprises a body forming a chamber, pair of nozzle s
3 opposing one another, said stream being divided so a portion
4 flows through each said nozzle with their streams flowing toward
5 and meeting one another in said chamber, said body having an
6 outlet port exiting the chamber.

1 15. (Cancelled) Apparatus according to claim 14 in which
2 said portions of said stream intersect at an included angle not
3 larger than 90 degrees.

1 16. (Cancelled) Apparatus according to claim 14 in which
2 said portions of said stream are axially aligned, and in which
3 said exit port exits the chamber laterally, midway between said
4 nozzles.

1 17. (Previously Amended) A system for accelerating the
2 solution of treatment gas into a liquid stream, said system being
3 adapted to receive and maintain said stream under pressure, said
4 system comprising:

5 an aspirating injector comprising a body having an
6 axial passage, a converging section, a throat section and a

7 diverging section in said passage in that order, an injector port
8 through said body entering said throat section and adapted to
9 receive treatment gas to be dissolved in said liquid stream, said
10 passage having an inlet port to receive said stream, and an
11 outlet port;

12 a collider comprising a body forming a chamber having
13 an inlet port and an outlet port, said inlet port being connected
14 to the outlet port of the injector, its outlet port being
15 connected to a fluid release receiving said stream from said last
16 mentioned outlet port for releasing the treated stream from the
17 system while maintaining the system under pressure; said collider
18 comprising a body forming a chamber, a pair of nozzles opposing
19 one another, said stream being divided so a portion flows through
20 each said nozzle with their streams flowing toward and meeting
21 one another in said chamber, said body having an outlet port
22 exiting the chamber, said outlet comprising the exit for all of
23 the stream which entered said chamber.

1 18. (Cancelled) A system according to claim 17 in which said
2 collider comprises a body forming a chamber, pair of nozzles
3 opposing one another, said stream being divided so a portion
4 flows through each said nozzle with their streams flowing toward
5 and meeting one another in said chamber, said body having an
6 outlet port exiting the chamber.

1 19. (Previously Amended) A system according to claim 17 in
2 which said portions of said stream intersect at an included angle
3 not larger than 90 degrees.

1 20. (Previously Amended) A system according to claim 17 in
2 which said portions of said stream are axially aligned, and in
3 which said exit port exits the chamber laterally, midway between
4 said nozzles.

1 21. (Cancelled) A system for accelerating the solution of
2 treatment gas into a liquid stream, said system being adapted to
3 receive and maintain said stream under pressure, said system
4 comprising:

5 an aspirating injector comprising a body having an
6 axial passage, a converging section, a throat section and a
7 diverging section in said passage in that order, an injector port
8 through said body entering said throat section and adapted to
9 receive treatment gas to be dissolved in said liquid stream, said
10 passage having an inlet port to receive said stream, and an
11 outlet port;

12 a reactor having an inlet port and an outlet port, the
13 inlet port being connected to the outlet port of the injector,
14 its outlet port connected to a fluid release receiving said

15 str am from said last mentioned outlet port for releasing the
16 treated stream from the system while maintaining the system under
17 pressure.

1 22. (Cancelled) A system according to claim 21 in which
2 said fluid release comprises a gas/liquid separator which
3 separates and releases the stream's liquid and the stream's gas s
4 which remain undissolved in said liquid.

1 23. (Cancelled) A system according to claim 22 in which
2 said fluid release further includes a regulator valve for the
3 liquid stream.

1 24. (Cancelled) Apparatus according to claim 21 in which
2 said reactor comprises a body having a central axis with an
3 internal cylindrical wall forming an axial internal cylinder, its
4 said inlet port adapted to receive said stream, and its said
5 outlet port adapted to discharge said stream with an increas d
6 dissolved amount of said treatment gas therein, said inlet port
7 and said outlet port being centrally located on said central
8 axis;

9 a nozzle in said inlet port directing said stream
10 axially into said cylinder;

11 a partial barrier extending laterally across said

12 cylinder dividing said cylinder onto a first chamber and a second
13 chamber, said barrier having an upstream face facing into said
14 first chamber and axially facing said nozzle, and a downstream
15 face facing into said second chamber and facing said outlet port;

16 said upstream face having a concave circular first
17 reflecting surface centered on said central axis and facing said
18 nozzle, the radius of said reflecting surface being smaller than
19 the internal radius of said internal cylindrical wall;

20 a plurality of axially extending arcuate blades, each
21 having an outer wall closely fitting to said internal cylindrical
22 wall, a dimension of radial thickness, and an inner wall
23 concentric with its said outer wall, said blades having axially-
24 extending side walls, said blades being angularly spaced from one
25 another to provide an equal number of axial slots between them;

26 a cove surface circularly surrounding said first
27 nozzle, extending to said inner walls of the blades and to their
28 intersections with said slots, whereby said stream discharges
29 from said nozzle so a major portion of it strikes said reflecting
30 surface, which reverses a major portion of the flow to the cove
31 surface which in turn reflects a major portion of said flow
32 toward said barrier along said blades and in said slots, said
33 partial barrier being pierced between with slots between said
34 slots to provide for flow from said first chamber into said
35 second chamber, thereby to pass said flow from the first chamber

36 into said second chamber, said outlet port discharging from said
37 second chamber.

1 25. (Cancelled) Apparatus according to claim 24 in which
2 said second chamber comprises a partial barrier facing toward
3 said outlet port, a plurality of blades and slots as in said
4 first chamber, said slots in the first and second chamber being
5 rotationally displaced from one another, whereby to form joggle
6 shoulders encountered by portions of the stream flowing across
7 the barriers, said second chamber including a cove receptive of
8 some of the flow across the barrier to reflect at least some of
9 the flow of the stream to the barrier in said second chamber,
10 which in turn reflects it to said outlet port.

1 26. (Previously Amended) A collider receptive of two
2 streams of a gas/liquid stream to accelerate the solution of the
3 gas into the liquid, said collider comprising:
4 a body forming a chamber, pair of nozzles opposing one
5 another, said stream being divided so a portion flows through
6 each said nozzle with their streams flowing toward and meeting
7 one another in said chamber, said body having an outlet port
8 exiting the chamber, each of said nozzles includes a converging
9 section, and twisting vanes in said converging section whereby to
10 impart a rotary motion to the outer region of the stream as it

11 flows through th nozzle.

1 27. (Original) A collider according to claim 26 in which
2 said portions of said stream intersect at an included angle not
3 larger than 90 degrees.

1 28. (Original) A collider according to claim 26 in which
2 said portions of said stream are axially aligned, and in which
3 said exit port exits the chamber laterally, midway between said
4 nozzles.

1 29. (Cancelled) A collider according to claim 26 in which
2 each of said nozzles includes a converging section, and twisting
3 vanes in said converging section whereby to impart a rotary
4 motion to the outer region of the stream as it flows through the
5 nozzle.

1 30. (Original) A reactor receptive of a stream of liquid
2 and bubbles of treatment gas, for accelerating the solution of
3 said gas in said liquid, said reactor comprising:

4 a body having a central axis with an internal
5 cylindrical wall forming an axial internal cylinder, its said
6 inlet port adapted to receive said stream, and its said outlet
7 port adapted to discharge said stream with an increased dissolved

8 amount of said treatment gas therein, said inlet port and said
9 outlet port being centrally located on said central axis;

10 a nozzle in said inlet port directing said stream
11 axially into said cylinder;

12 a partial barrier extending laterally across said
13 cylinder dividing said cylinder onto a first chamber and a second
14 chamber, said barrier having an upstream face facing into said
15 first chamber and axially facing said nozzle, and a downstream
16 face facing into said second chamber and facing said outlet port;

17 said upstream face having a concave circular first
18 reflecting surface centered on said central axis and facing said
19 nozzle, the radius of said reflecting surface being smaller than
20 the internal radius of said internal cylindrical wall;

21 a plurality of axially extending arcuate blades, each
22 having an outer wall closely fitting to said internal cylindrical
23 wall, a dimension of radial thickness, and an inner wall
24 concentric with its said outer wall, said blades having axially-
25 extending side walls, said blades being angularly spaced from one
26 another to provide an equal number of axial slots between them;

27 a cove surface circularly surrounding said first
28 nozzle, extending to said inner walls of the blades and to their
29 intersections with said slots, whereby said stream discharges
30 from said nozzle so a major portion of it strikes said reflecting
31 surface, which reverses a major portion of the flow to the cove

32 surface which in turn reflects a major portion of said flow
33 toward said barrier along said blades and in said slots, said
34 partial barrier being pierced between with slots between said
35 slots to provide for flow from said first chamber into said
36 second chamber, thereby to pass said flow from the first chamber
37 into said second chamber, said outlet port discharging from said
38 second chamber.

1 31. (Original) A reactor according to claim 30 in which
2 said second chamber comprises a partial barrier facing toward
3 said outlet port, a plurality of blades and slots as in said
4 first chamber, said slots in the first and second chamber being
5 rotationally displaced from one another, whereby to form joggle
6 shoulders encountered by portions of the stream flowing across
7 the barriers, said second chamber including a cove receptiv of
8 some of the flow across the barrier to reflect at least som of
9 the flow of the stream to the barrier in said second chamber,
10 which in turn reflects it to said outlet port.

1 32. (Cancelled) A reactor according to claim 31 in which
2 said fluid release comprises a gas/liquid separator which
3 separate and releases the stream's liquid and the stream's gas s
4 which remain undissolved in said liquid.

1 33. (New) A system according to claim 17 in which each of
2 said nozzles includes a converging section, and twisting van s in
3 said converging section whereby to impart a rotary motor to the
4 outer region of the stream as it flows through the nozzle.